American Potato Journal

Volume 15 April, 1938 Number 4

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PUBLISHED MONTHLY BY

THE POTATO ASSOCIATION OF AMERICA

Somerville, New Jersey

and

New Brunswick, New Jersey

Subscription Price $2.00 Per Year

Entered as second class matter at Somerville, N. J., January 30, 1934, under Act of March 3, 1879.

Accepted for mailing at special rate of postage provided for in section 412, Act of February 28, 1925, authorized on March 14, 1928.

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THE POTATO ASSOCIATION OF AMERICA

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AVOID A CROP SURPLUS

The early crop has been planted and the acreage is reported to be approximately six per cent smaller than last year. The failure to effect a greater decrease in acreage in certain of the southern states is explained by some observers on the basis that many of the growers could obtain credit for the purchase of fertilizer and other supplies, only by agreeing to plant potatoes. If this is true, the credit system may again be one of the chief factors contributing to the potato grower's difficulties. At the Washington conference last year it was suggested that this matter might be adjusted although little or no progress has been made in this direction. The growers in the southern states appreciate that they face a difficult situation and have asked the Agricultural Adjustment Administration for a marketing program to take care of an anticipated crop surplus. A special effort is being made by representatives of the U. S. Department of Agriculture to have this in operation in time to be of some assistance in marketing the early crop.

A large portion of the total potato acreage remains to be planted. Growers in the late states know that overproduction must be avoided if they are to receive decent returns on their investment. They appreciate also that little can be done after the crop is planted. Marketing agreements and orders have a stabilizing influence but even with their adoption, in the case of a large crop surplus, it is doubtful if a grower can expect a price as satisfactory as would follow a reduction in acreage. The danger of overproduction and its relation to price cannot be over-emphasized. It has been difficult to prevent overproduction in the past and now, when there seems to be some thought that if we get into trouble the government will help us out, it would appear to be even more difficult. Some day, however, we must correct this situation ourselves since it is difficult to believe that the government can continue indefinitely to spend large sums to correct our mistakes.

THE MESABA POTATO[1]

F. A. Krantz and A. G. Tolaas

Minnesota Agricultural Experiment Station, St. Paul, Minn.

The Mesaba potato is the result of potato breeding work by the Minnesota Agricultural Experiment Station in co-operation with the United States Department of Agriculture and other state experiment stations cooperating in the national potato breeding program.

Origin and Development

The Mesaba variety was obtained from a cross between the Russet Rural and a seedling selection, number 41-1, of the Early Ohio variety. It has been tested most extensively in Minnesota and Iowa. The cooperation of the Iowa Agricultural Experiment Station in the growing and testing of this and other selections has materially aided in the progress of this work. At many locations in Minnesota the Mesaba has proved to be a smoother, more attractive market potato than the Cobbler. It is introduced with the expectation that many growers using early varieties may find, upon testing this variety, that it will be more suitable to their need.

Technical Description

Plants medium large, erect, compact; stems thick, prominently angled; nodes slightly swollen, green; internodes reddish; wings waved, serrate, green; stipules large, green, pubescent; foliage somewhat rugose; leaves medium long, broad, midrib green and pubescent; primary leafllets close, three to four pairs, medium large, mean length 89.2 mm; mean width 60.1 mm; index 67.3 (Irish Cobbler same location, length 99.9; width 71.4; index 71.5): petioles green, secondary leaflets many, on midrib between pairs of primary leaflets, on primary leaflet petioles, at junction of mid-rib and petioles of primary leaflets; tertiary leaflets medium to many in number; inflorescence axillary, much branched, leafy bracts none;

[1]Published as Journal Series Number 370 at the Minnesota Agricultural Experiment Station.

peduncles short, pubescent, reddish; pedicels short, reddish, pubescent.

Flowers: calyx lobe tips short, little pigmented to green, pubescent; corolla very small (diameter 20-25 mm), color a light reddish tinge; anthers small, pale yellow; pollen scant to none, sterile; style straight, relatively long extending beyond corolla at bud stage; stigma globose, multilobed, green; fruit globular, green at base shading to white at terminal end.

Tubers short, medium thick, roundish, mean length 72.4 mm; width 62.0 mm; thickness 47.4 mm; indexes, width to length 85.7, thickness to width 73.9, thickness to length 63.3; skin relatively thick, not easily feathered, slightly flaky to smooth, self-colored, dark creamy buff; eyes shallow, same color as skin; eyebrows medium long, curved, medium prominent; flesh white; sprouts very faint reddish tinge at tip when developed in dark; maturity early, same as Irish Cobbler.

CHARACTERISTICS

The Mesaba is a round white potato of the smooth Rural type and is similar to the Irish Cobbler in maturity and yield. In table 1 is given the yield when compared with the Irish Cobbler for four years at a varying number of locations.

TABLE 1.—*Average yield in bushels on an acre of Irish Cobbler and Mesaba varieties for four years at a varying number of locations*

Year	1933	1935	1936	1937	1937
Number of locations	6	3	10	3	7*
Irish Cobbler	157.7	136.3	111.6	152.7	184.4
Mesaba	161.2	139.4	113.7	174.2	206.7

*Growers test plots.

The metabolic efficiency of the vine appears to be higher than the Irish Cobbler. The average ratio of tuber to vine weight at three locations was as follows: Irish Cobbler .97; Mesaba 1.22; Warba

1.36. It is of interest in this connection to note that the Mesaba variety consistently outyielded the Irish Cobbler under conditions favoring large vine growth. The tuber set has usually been slightly heavier than the Irish Cobbler and distinctly less than the Warba. This is illustrated by the average number of tubers on each plant in the three locations. The mean tuber set on each plant was as follows: Irish Cobbler 3.81, Mesaba 4.02 and Warba 5.07.

The Mesaba is resistant to some virus diseases, and susceptible to others. Plug tuber graft inoculations both with mild and with crinkle mosaic stock produced little or no noticeable effect.

THE COBBLER SEED SUPPLY OF THE UNITED STATES

C. L. Fitch

Agricultural Experiment Station, Ames, Iowa

Thirty-seven per cent of the seed certified in the United States in 1937 were Cobblers. The Cobbler is the leading variety of the United States and of our state. In studying the Cobbler seed supply of the central west, we were led to a study of the Cobbler seed supply of the United States and of North America, because our foundation stocks are inter-regional and international.

Moreover we find that the Cobbler seed of foundation and even of no-virus grade are the cheapest seed we can buy for the growing of seed and perhaps for the production of table stock as well.

Our muck land growers are accustomed to producing their own main crop seed from northern-grown certified seed. We call this home-grown seed "first year seed."

The Interstate Index-Yield Plots

The extension studies herein reported upon were stimulated following a loss of approximately 20,000 bushels of yield by our largest grower in 1935, because of an unusually poor grade of "first year" seed produced by him in 1934, from seven carloads of seed certified in the Hoople district of North Dakota during 1933, when there was a severe infestation of insects. In Iowa, spindle tuber, the most serious disease in Cobbler seed, was extremely damaging in this case. Therefore, in 1936 on a moderate scale and in 1937 on a considerable scale, we studied the performance of Cobbler seed of various sources and grades.

These plots are a cooperative undertaking of the Agricultural Extension Service of Iowa State College represented by the writer, and of the Commissioner of Agriculture of the state of Minnesota represented by A. G. Tolaas, chief inspector of the seed potato inspection service of Minnesota.

In 1936 we used four rows untouched by the ten-row sprayer wheels and about 1,000 feet long. In 1937, we had 100 samples of seed and used more than twice as much space for each set of plots. We also planted a duplicate of the plots seventy-five miles away, and were unfortunate in suffering an entire loss of one set of plots by flood. There was a total of three or four replicas, each approximately 1/300 acre.

In June, we indexed the plots. In 1936, this work was done by A. G. Tolaas and F. A. Krantz of Minnesota. In 1937, Mr. Tolaas was assisted by R. C. Hastings and E. J. Taintor, North Dakota; Inspector Regnier and Felix A. Nylund, Minnesota; J. W. Brann, Wisconsin, and S. G. Peppin and J. W. Boulter, of Charlottetown, Prince Edward Island.

Factors in Cobbler Seed Value, Important but Minor to Freedom from Virus

From other studies and from experience, we have learned that bruises, poor healing of the same and consequent dry rot are a large detriment to the value of seed Cobblers, especially in the larger tubers. The Red River Valley ships us scabby tubers from her light soils, and tubers affected with *Rhizoctonia* from her heavy soils. The Valley has long hours and many days of sunshine and of high soil temperatures; which may be responsible for the serious *Fusaria* infections. If one has the luck or takes the pains to select in person or by his own representative, he may get from closely planted, well shaded, and previously summer-fallowed Red River land, potatoes free from scab because grown on heavy land; free from *Rhizoctonia* because harvested before cool rains; and fairly free from *Fusaria* if dug early from shaded heavy, somewhat moist soil. He may also get seed free from dry rot if harvested with a Kid Glove digger and picked into rubber-covered baskets, handled gently and then stored in moist air at 60° F. or slightly warmer for a period of two weeks immediately after harvesting. The safest seed source, so far as dry rot, scab and *Rhizoctonia* are concerned should be a region with a moist, cool climate and a light soil of acid reaction.

Dry rot in storage is often followed by wet rot in the spring if the tubers are placed in warm damp storage houses. The same thing happens in the ground and causes loss of seed food and of stand, growth and yield. Similar conditions elsewhere will cause the same troubles that we experience with the Red River seed.

Wilt

Seed Cobblers from warm soils distribute *Fusaria,* and under conditions favoring *Fusaria,* infect the plants, the new tubers and the soil. We do not have data on the matter, but it seems natural that *Fusaria,* in warm climates, will reduce yields even where no diseased plants are noted. If one buys seed from climates similar to that of Prince Edward Island he will secure seed having no wilt except *Verticillium* and often this will not be present. *Verticillium,* moreover, cannot develop when subjected to the warm conditions where most Cobblers are planted.

In general, the *Fusaria* becomes worse as one goes south to warmer climate, and west where more sunshine and higher soil temperatures prevail. *Verticillium* is worse as one goes east to less intense sunshine and north to cooler climates. *Verticillium,* however, is not always present in the north and east. For example, Donald Folsom states that it was almost unknown in Aroostook from 1923 to 1936, but appeared again in 1937. *Verticillium* is unknown in regions of warmer soil, regardless of the source of seed.

R. W. Goss states that *F. eumartii* which causes both stem end rot and wilt thrives at a lower temperature than *F. oxysporum.* He states that although most plants die with wilt in the warmer years, still there is the most total infestation in northwestern Nebraska in those years most favorable for production. It is to be remembered, however, that soil temperatures are always relatively high in northwestern Nebraska when compared with areas farther north and east.

In the far south where potatoes are grown in the winter, *Fusarium* wilts are of no economic importance, and *Verticillium* may develop. The same is true in the far northwest, particularly on the Pacific slope. Large users of seed should consider these facts seriously.

Phytophthora

East of the Mississippi along the Canadian border and for another tier of states south, and along the Gulf and South Atlantic coast, as

well as on the northern Pacific slope, we have trouble with *Phytophthora.* The seed for those regions should be free from this disease. This requires thorough spraying with Bordeaux mixture if produced in regions where late blight occurs and also precautions in certification. These precautions may be avoided by the use of seed grown in the northwest where it is too dry for late blight, or in the western part of the corn belt where it is both too warm and too dry for the disease to develop on the plant and to infect the seed.

VARIETAL PURITY

Good Cobbler seed of course must be free from Green Mountains and Rurals or other mixtures. Certification alone has not entirely eliminated mixtures. Mixing continues with Green Mountains in Maine and in Wisconsin, particularly in Maine; and with Warbas in the Red River Valley. Certified seed that has originated from foundation stock and the rigid requirements for that grade has been found to be reliable. Even the best of growers should be discouraged from growing too many kinds of certified seed and from storing and cutting them in the same house. Sacks of cut seed are difficult to identify and easily mixed.

FREEDOM FROM VIRUS THE MOST IMPORTANT QUALIFICATION

The results of our test plots showed that yields increased with official classifications of seed: that is, the yields were higher from certified seed then from our "first year" seed; higher from seed of regis-

TABLE 1—*Yields increase with superior official classifications*

Year	Source of Seed	Lots	Replications	Yield Bu. to the Acre	Increase Bu to the Acre
1936	Certified	17	34	278.8	....
1936	Foundation stock, Minn., Wisc., Ont., P. E. I.	7	17	341.3	62.5
1937	First Iowa crop from Cert.	12	26	522.4	....
1937	Certified	9	16	564.5	42.1
1937	Foundation Stock, Minn., Wisc., N. D.	18	34	602.0	37.5
1937	Foundation Stock, P. E. I.	9	22	620.0	18.0
1937	Gain of P. E. I. on virus stock over "first year Iowa"	..	....	....	97.6

ered grade (⅕ of 1 per cent virus or less) than of average certified grade; and higher from seed in which no virus had been found than the yields from registered seed. These results are shown in table 1.

The yields in the current crop increased as the virus found in the current crop decreased. The best long-time virus-free Prince Edward Island stock, where our yields were large, yielded 99 additional bushels on each acre when compared with our own "first year" seed. The chief source of the virus in the current crop was the virus found in the seed stock of the previous year. The virus prevalent in the current season roughly parallels, in higher percentages, the virus found by inspectors in the previous year. These data are given in table 2.

TABLE 2—*Relation between health and yields*

Year	Source of Seed	Lots	Replications	Per cent		Yield Bu. to Acre	Increase Bu to the Acre
				Virus[A]	Diseases[B]		
1936	Minn., Wisc., Ont.	6	12	.27	1.8	272.2	...
1936	Minn., Wisc., P. E. I.	20	40	0	0	312.2	40.0
1937	First year in Iowa	12	25	*	6.5	522.4	...
1937	Minn., Wisc., N. D.	6	12	.32	2.7	564.5	42.1
1937	Minn., Wisc., N. D.	9	18	.07	2.0	584.4	19.9
1937	Minn., Wisc., N. D.	7	14	0	1.1	603.2	18.8
1937	Prince Edward Island	8	21	0	.4	621.8	18.6

A reduction in virus in 1937 of 6.1 per cent. An increase in yield of 99.5 bushels.

A. The year before these tests.

B. The year of these tests.

*No record but probably approximately 0.5 per cent.

A review of certification in 1937 in most of the states and provinces producing Cobbler seed indicates that our states have very few fields in which no virus is found, and far fewer in which no virus has been found for so long a period of years that it indicates its complete eradication. The same is true of New Brunswick, as is shown in table 3. A much better situation is found in Ontario and still a better one in Nova Scotia. However, it is evident that Prince Edward Island is the champion producer of Cobbler seed. In 1937, Prince Edward Island had about thirty times as many fields in which no virus was found as did all the United States, and more than twenty-four times as many as the three other afore-mentioned provinces combined.

TABLE 3—*Diseases reported in Cobbler fields in* 1937

State or Province	Official Reporting	Fields Passed	The Same Fields with No Virus 1937	The Same Farms with No Virus		The Same Fields with	
				1933-37	1936-37	No Wilt 1937	No Blackleg 1937
Nebraska	Koehnke	33	2	...	2	...	...
Idaho	Bennett	6	0	...	...	...	...
Michigan	Moore	50	12	...	...	...	7
Montana	Harrington	5	0	...	...	...	...
Washington	Gaines	8	0	...	...	...	...
Minnesota	Tolaas	462	3	...	...	...	...
New York	Fernow	35	12	...	...	...	...
Maine	Newdick	409	17	...	...	13	13
North Dakota	Gillig	240	*	...	...	...	...
Colorado	Metzger	28	6	2	2	...	...
Wisconsin	Milward	19	0	...	...	...	...
Ontario	Gussow	118	27	8	9	16	16
Nova Scotia	Adams	224	48	0	8	43	43
Prince Ed. Is.	Peppin	2245**	1816	1792	1816	1295	1148
New Brunswick	Gussow	562 acres	0	"Average about ⅓ per cent virus"			
New Jersey	Mott	359 acres	...	...	...	...	...

*All blanks indicate no report.

**These Prince Edward Island figures for 1933-'37 and for 1936-'37 are not exactly the same fields as the 1816 fields of 1937. We accepted the figures already in Mr. Peppin's office as averages for the years, because of the enormous work that would have been involved in running down in his files the records for the same 1816 farms. It is evident that they were pretty much the same farms.

The superiority of Prince Edward seed Cobblers is still more phenomenal when one considers the very large proportion of fields that had also been free in 1936, and for five years, previous to that date. These fields have shown no wilt and no blackleg.

It is foolish to question the quality of certification work in Prince Edward Island. Our own checks fully approve of that work as well as our yields.

Our own acquaintance with Prince Edward Island seed traces back to our late friend, E. D. Askegaard of Moorhead, Minnesota, a keen and devoted student of the potato crop and one-time vice-president of this Association, who went to Prince Edward Island twelve years ago and bought eight carloads of seed for Red River Valley use. This acquaintance with this seed has been kept up by

Mr. Ben Picha, manager of the Hollandale Marketing Association, himself a Red River Valley man and a friend of Mr. Askegaard, who each year for a long time purchased about four carloads of the best of Prince Edward Island Cobblers for seed growing to Hollandale, Minnesota.

In the early twenties, with the co-operation of Mr. Tolaas, it was found in yield tests that the Fosston, Minnesota neighborhood had a superior stock of Cobblers. This superiority has been continued with the aid of Mr. Tolaas' certification. It seems to have been caused originally by the chance arrival of a superior carload of second size seed, and to have been continued in their widely scattered and isolated potato fields.

Much of the good seed of Minnesota and North Dakota may be traced to Prince Edward Island or to Fosston. Many of the good Cobblers of Wisconsin have Prince Edward Island as their origin. The majority of the good seed Cobblers of the northeastern part of the United States originated either directly or indirectly in Prince Edward Island.

FIG. 1. ON THE RIGHT STANDS DOUGLASS AITKIN OF FORTUNE BRIDGE, PRINCE EDWARD ISLAND. ON THE LEFT, S. G. PEPPIN, SENIOR INSPECTOR FOR THE PROVINCE.

Mr. Aitkin's Cobbler fields have been reported free from virus for the years 1923 to 1937 inclusive, and from 1912 to 1921 inclusive. In 1922, they were close to a field of Green Mountains and some mosaic was found in them. This is the best record known to us, and well may be an American or a world record for Cobblers.

In August of 1937, the writer visited Prince Edward Island and examined the fields in company with Mr. Peppin. It is an island in the Gulf of St. Lawrence, far north, with an area about equal to four Iowa counties. The soil is soft in nature—of sandstone origin, and acid in reaction, just the type of soil that our experience indicates should be best. The growers are obliged to spray well and they do. Seed is not passed for certification nor put into storage until it has lain covered in sheds long enough for *Phytophthora* to develop if present.

DUTY-FREE IMPORTATION OF FOUNDATION SEED COBBLERS

It is clear to me that it would be cheaper and better to allow our own growers of certified Cobbler seed to import, from Prince Edward Island, seed free from virus for five years or more, duty-free, rather than to index, hill unit and seed plot at much larger expense, only to have too much virus. Permits for duty-free importation, of course, would carry the official five-year record of that seed, and might carry also an affidavit from the United States user that such importation would be planted for the growing of seed. It is a general principle of world welfare, that each nation should produce what it can produce better than any other nation and that it should be unhampered in trading its superior product for products of other countries. One thousand carloads of five-year virus-free Cobbler seed each year would be only about one-twentieth part of the Cobbler seed supply of the United States. Why not admit that Prince Edward Island can for some reason, grow better and cheaper foundation stock than we do or can grow and let the 1,000 carloads enter duty free until such time as an equal quantity of Cobbler seed potatoes, which have been found to be free from virus for at least five years, is being produced in the United States. It would be sensible and would pay us handsomely and promptly. I, for one, would not feel badly if it made Prince Edward Island still more prosperous. We sell them lard and pork, breakfast foods and good automobiles by the trainload! Let's be a little mellow and reasonable in this matter of long-time virus-free Cobbler seed for seed growing in the United States of America.

SOIL FERTILIZER AND NUTRITION STUDIES WITH THE POTATO IN 1937*

ORA SMITH

Cornell University, Ithaca, N. Y.

Results of investigations published during the past twelve months on fertilizers and fertilization, soil reaction, soil fertility, cover crops and sand and solution cultures with the potato are summarized in this report. Although many periodicals have been reviewed in assembling this material it is not claimed to be complete. Some references which have not been abstracted in this review are included in the bibliography with the literature citations. Many of the titles in a foreign language have been translated.

Brown (8) has published a discussion on some of the important changes which have taken place in fertilizers since 1900. He considers such topics as changes in fertilizer materials, composition, concentration, reaction, minor elements and placement. Carolus (16) states that the potato crop has a large total nitrogen, phosphorus, potassium, magnesium and calcium requirements. The maximum nutrient requirement occurs 50-80 days after planting. In 1936, during this 30 day maximum absorption period, an acre of potatoes absorbed N, P, K_2O, and Mg O at the rates of 1.66, 0.3, 3.33 and 0.3 pounds daily respectively. Tests made on the stems of potato plants at critical periods, or in diagnosing deficiency symptoms under conditions similar to those of this experiment should, under optimum growing conditions, indicate a minimum soluble N content of 700-800 ppm.; a minimum soluble P content of 150 at the beginning and 60 ppm. at the close of the season; a minimum K_2O content of 2,200 at the beginning and 4,500 ppm. at the end of the season; a minimum MgO content of 275 at the beginning and 800 ppm. at the end of the season and a minimum CaO content of 600 at the beginning and 1,400 ppm. at the end of the season. Ware (72) conducted experiments in Alabama using three rates of fertilizer application, 1,000, 1,500 and 2,000 pounds to the acre, with spacing of seed pieces of 20, 16, 12, and 8 inches at each rate of fertilizer application. He reports that a combination of 2,000 pounds of fertilizer to the acre with a 12 inch spacing is the most desirable. Opitz, Rathsack and Morgenroth

*Paper No. 167, Department of Vegetable Crops, Cornell University, Ithaca, New York.

140245

(48) with field experiments in Germany indicated that the soil was definitely deficient in N and K_2O but not in P_2O_5. With 54 pounds of nitrogen on each acre, a 1-1-0 ratio was insufficient but various ratios 1-1.5-1 to 2 gave practically the same results. In some further tests nitrophoska proved equal in effects to equivalent mixtures of other fertilizer salts.

Singleton and Wheeting (62) have grown potatoes on a fine sandy loam soil in a three year rotation with corn and spring wheat in Washington. The soil was fertilized with horse manure, sheep manure, fish scrap, alfalfa hay, wheat straw, bone meal, nitrate of soda, sulfate of ammonia, treble superphosphate, sulfate of potash and gypsum. Throughout the cropping period of twelve years, potato yields have tended to decrease regardless of treatment of the soil. The analyses show that some treatments improved the quality of the soil but the effect on potato yields was not observable. It is likely that environmental factors, such as the presence of wireworms and plant diseases may have influenced the results. Wessels and Hartman (74) reported on the value of autumn and winter cover crops grown during the 1923-1936 period. Eleven different cover crop treatments were compared as well as plots receiving 10 tons of manure to the acre with no cover crop and plots with no manure and no cover crop. During a period of 8 years rye cover crop plots averaged 23 bushels of marketable Irish Cobbler potatoes on each acre higher than did plots without cover crop or manure. Rye and vetch together similarly increased yields 22 bushels from each acre, whereas 10 tons of manure to the acre gave an increase of 30 bushels of potatoes. No other cover crop increased yields significantly. None of the cover crop treatments changed the soil acidity appreciably. In a 3 year experiment with cover crops on a Norfolk sandy loam soil Hester (28) found marked increases in yields of potatoes following soybeans, sorghum, and a combination of sorghum and soybeans. In soil containing 2.2 per cent organic matter the contents of water soluble P_2O_5 and replaceable CaO were progressively increased and the content of water soluble Al_2O_3 was progressively decreased by increasing the pH in increments of 0.5 unit from 4.5 to 7.0. The yield of potatoes increased with the pH. Brown (6) obtained relative yields of potatoes continuously and potatoes alternating with clover and timothy of 100 and 109 respectively for a 5 year period. During the two dry years of the five, however, the potatoes in rotation outyielded the continuous potatoes 17 and 32 per cent.

Investigators in Montana (24) have arrived at the following conclusions, from phosphorus applications to potato soils. Phosphate-treated plants germinate more quickly, early growth is more rapid, root development more extensive, heavier tuber set and earlier set, increase in yields and improvement in grade, smoother potatoes of better shape, heavier netting of netted varieties, and earlier maturity than potatoes grown in soil without phosphorus applications. Van der Paauw (50) concludes that to ensure a maximum production of potatoes there must be present at least 25 potassium units during growth. The correlation between the amount of potassium found in the fall and the crop following is not large. An application of an amount of potassium just sufficient to remain above the critical borderline, produced the best crops. Hester and Blume (30) obtained an increase of 158 per cent and 196 per cent in yields respectively with 1 ton to the acre of 6-6-5 and 6-6-10 over 6-6-0 on fine sandy loam soil poor in available potash. On a Norfolk fine sandy loam that tested fair plus in potash and good in phosphorus gave only 12 per cent increases in yield with 6-6-5 and 6-6-10 over 6-6-0. Prokoshev (52) found that in Russia K_2SO_4 had certain advantages over KCl for potatoes. Berkner (4) noted that the use of potassium salts, particularly 40 per cent KCl, at the rate of 125 kg. *per hectare* depressed the starch content slightly. The yield was not affected by different forms of K salts. KCl increased the chlorine content of the tubers by as much as 68 per cent. The nitrogen uptake is not affected by K fertilization but the N content varies in different varieties. The nutrient uptake tends to increase with later planting time and is greatest with nitrogen but the chlorine content is depressed. The increased P_2O_5 content is regarded as favoring the seed value. The kind of potash fertilizer used the previous year did not influence the potato yield nor quality the following year. Nemec (46) working in Czechoslovakia reported that on soils below pH 5.5, applications of potash salts tended to depress the starch content of potato tubers, this effect being most marked in the case of kainite and least marked with sulfate of potash magnesia. On the other hand, on slightly acid to alkaline soils applications of potash in chloride form (kainite and 40 per cent potash manure salt) caused only a slight depression of the starch content of potato tubers, whereas applications of potash as sulfate increased it considerably. In slightly acid to alkaline soils considerable increases in yields of tubers were obtained with potash, whereas in the acid soils the increases in yields due to potash were much smaller indicating that an acid reaction of the soil

tends to influence unfavorably the response of the crop to potash manuring. When kainite, 40 per cent potash manure salt, sulfate of potash, and sulfate of potash magnesia were compared as sources of potash on slightly acid to alkaline soils, the greatest increases in yields were obtained from 40 per cent potash manure salt. On the acid soils the increases in yields were considerably lower than on the slightly acid to alkaline soils.

Smith (65) conducted experiments on effect of soil reaction on the potato plant through a period of five years. Soil reactions, more acid than pH 4.8, resulted in a reduction of the number of tubers on each plant as well as total yields. At the higher soil pH values there was a marked reduction in the number of No. 1 size and in the total number of tubers on each plant. The most alkaline soils also produced smaller No. 1 size tubers. In general, no significant differences in total yield exist between plots with reactions of approximately pH 4.8 to 7.1. Significant decreases in yields occur in plots with soil reactions higher than approximately pH 7.0 to 7.5. There was a gradual increase in the percentage of scabby tubers from the most acid plots to those with reactions of approximately pH 6.51 to 7.8. In soils above these reactions the percentage of scabby tubers is always markedly reduced. Smith and Nash (63) have analyzed soils of pH 4.74, 5.65, 6.85, and 7.92 for available nutrients as well as analyzing potato plants grown on these soils. Although differences in availability of plant nutrients and in the composition of the plants have been found they were unable to explain the decreased yields obtained at high soil pH values on the basis of these analyses. The low supply of available manganese at high pH values is suggested as a possible causal factor. Liesegang (41) found that potatoes suffered considerably from the effects of soil acidity and the use of physiologically acid fertilizers. Considerable increases in yield were obtained from plots on which the effect of physiologically acid fertilizers was counteracted by additions of lime and also from those receiving physiologically alkaline fertilizers. If the average yield of unfertilized plots is taken as 100, the yield of potatoes with physiologically alkaline fertilizers was 183 in one year and 128 in another. Hester (27) concluded that both dolomitic limestone and hydrated dolomitic lime were superior to either high calcium limestone, hydrated high calcium lime, oyster shell or marl in increasing the yield of potatoes on Sassafras sandy loam soil. The pH values of the soils of the plots at the time the potatoes were harvested were: check, 4.57; hydrated high calcium lime, 5.46; hydrated dolomitic lime, 5.57;

high calcium limestone, 5.21; dolomitic limestone, 5.21; marl, 5.13; and oyster shell, 5.18.

Smith (64) showed that boiled and steamed tubers which had been grown at a soil reaction of pH 7.92 are usually more attractive in color than those grown at a lower pH. Those grown in soil of low pH retain their shape better and slough and break up to a lesser extent when boiled than tubers which had been grown in less acid or alkaline soils. There appeared to be no correlation between the content of K_2O in the tuber and its tendency to blacken. The mealiest tubers and those which maintained their form without breaking apart or sloughing were those grown in soils with a low supply of potassium, high nitrate supply and a high moisture content. Tottingham, Nagy and Ross (67) found that when the soil content of available K_2O was less than 200 pounds to the acre potatoes of several varieties blackened after cooking. This response was negligible when the supply approached 400 pounds. Opitz (47) detected no definite correlation between the tendency toward deterioration in successive generations of different varieties and yield capabilities during four years experiments. The starch content tends to decrease with subsequent generations of seed stock which may be partly related to the smaller average size of the tubers. The starch content is largely independent of the planting time.

Vlasova (70) found that lime became injurious to potatoes the third year after its application. The high concentration of calcium in the soil solution is held responsible for the injurious effect. It was found that additions of KNO_3 and NH_4NO_3 obliterate the injurious effects of the calcium. It is supposed that the disturbed nutrient balance is responsible for the calcium injury. Muller (45) states that the application of 35 quintals of lime *per hectare* reduced the percentage of potato tubers affected with medullary necrosis from 94.8 to 10.4 per cent. Stable and green manures and $(NH_4)_2\ SO_4$ increased losses from the disease and superphosphate reduced them.

Brown (7) states that the following cooperative experiments are being conducted in several states with potatoes: (1) a comparison of continuous and broken band application at different rates of application, (2) a study of differential placement of fertilizer constituents and (3) a comparison of pellet and ordinary fertilizer. Martin, Cummings and Brown (44) found no significant differences in yield in New Jersey between continuous and broken band methods of placement. A comparison of continuous bands on each side of the row with a continuous band on only one side at 2,000 pounds to the acre application resulted in slight increases in yield in favor of double bands. Hough-

land, Strong, Redit and Schoenleber (34) compared broken band and continuous band placements of fertilizer in Virginia. The results obtained with broken band application give no indication of an advantage from the method of application. Houghland, Smith and Cumings (33) compared band placements of 5 inches and 7½ inches long with 10 inch and 7½ inch skips with continuous band placements at rates of 1,500, 1,750 and 2,000 pounds to each acre. Yields from hill placement showed no significant differences compared with the continuous band method except at 1,750 pounds in which case the hill placement gave a significantly lower yield than the corresponding continuous band placement. The yields, in general, increased as the amount of fertilizer was reduced from 2,000 to 1,500 pounds to the acre. Dry weather may have been partially responsible for this increase. A light mixing of fertilizer around the seed piece usually results in slightly higher yields on Long Island than side placement in bands. Chucka (17) compared three sizes of granulated fertilizer pellets with regular fertilizer in two methods of placement. The placement in which the fertilizers were mixed lightly with the soil at the side of the seed pieces gave a somewhat higher yield than the standard side placement. The average yields for both placements tend to increase rather consistently with increase in size of pellets. Single and double band placements with regular fertilizer were also compared. With the 1,750 pound rate the double band placement produced a higher yield but with the 2,000 pound rate a higher yield was obtained with the single band placement. Bushnell (12) reported that at applications of 4-8-8 fertilizer above 500 pounds on each acre the continuous band gave slightly higher yields than the broken band placement. A comparison of pellet and powder forms of fertilizer showed no significant differences in yield. Bushnell (15) found that the yields could be increased by applying certain fertilizers and lime to the subsoil. Yields were obtained in descending order with the following materials: Ammophos, lime-superphosphate, superphosphate, and hydrated lime. Loosening the subsoil without any application of fertilizer or lime produced the lowest yield. Bushnell attributes these increases mainly to correction of toxicity by decreasing the acidity. Houghland (31) found a very definite retardation of sprout emergence where fertilizer was placed under the seed compared with side placements. Slow emergence may also be expected where the fertilizer is mixed with the soil in direct contact with the seed.

Serdyukov (59) working in Russia reported that $(NH_4)_2\ SO_4$ applied directly under the tubers decreased the yield of potatoes. He found that side applications proved to be the best.

Taylor and Howatt (66) found that low available magnesium in some New Brunswick soils caused chlorotic, unhealthy potato plants with reduced yields. This condition was corrected by adding 60-100 pounds of $MgSO_4$ to the soil on each acre. Spraying the foliage with $MgSO_4$ also corrected the defect. This indicates that there was insufficient magnesium present for normal chlorophyll development and function. Low magnesium content was also often associated with low phosphorus. Berkner (3) investigated the action of a fertilizer containing 20 per cent MgO, 12 per cent nitrogen as NH_3 and 11 per cent as nitrate by pot and field experiments with potatoes with other fertilizer mixtures for comparison. The pot experiments indicate that the MgO had a definite value as a partial substitute for CaO and with a one-fourth addition of the latter was as effective as a full liming with equivalent nitrogen. In the field experiment the MgO had an especially favorable effect upon yields of tubers and of starch. This was attributed to stimulation of chlorophyll formation when Mg was supplied.

Dennis (19) has recently published a review of the work with boron applications to potato soils and cultures. In dry years boron deficiency symptoms are likely to appear and at these times cautious boron manuring is likely to advantageously influence the crop. In wet years it probably will have no significant effect. Burgevin (11) working in France discovered that the use of sodium borate as a soil amendment on a light soil with a pH of approximately 7.0 caused significant increases in potato yields whereas on a loam soil of pH 7.5 it showed negligible effects except in one case when there was a decrease in the yield. Vincent (69), however, found that boric acid acts principally on the flowering of the potato plant. It is not concentrated in the tubers which indicates that this element does not act in the same way as the properly-called fertilizing elements. Van Schreven (58) reported that for field practice 20 kg. of borax *per hectare* is distinctly too much for potatoes.

Van Schreven (57) grew potato plants in water cultures in the presence of chemically pure nutrients with and without added zinc. In the zinc-free cultures deficiency symptoms and growth retardation were quite marked, indicating that zinc is a necessary nutrient for potatoes. Results obtained by Cooper, Moore and Wallace (18) from the Charleston, South Carolina truck crop area show that the addition of manganese sulphate to the soil has very markedly increased the yield of potatoes. Hester and Carolus (29) in 14 experiments in Eastern Virginia found that applications of Cu. Zn, and Mn sulfates did not significantly increase the yields of potatoes.

Houghland (32) has shown that potatoes may be grown successfully on land flooded with salt water if the salt content is below 0.1 per cent at time of planting and normal rainfall occurs throughout the season. Under greenhouse conditions the growth of plants and tubers was affected when the salt content of the soil reached 0.1 per cent. With 0.2 per cent salt no tubers were formed and a disturbed condition of apical dominance was evident. Baslavskaya (2) with field and sand cultures found that with the increase of chlorine in the medium the chlorine content of the potato plant as a whole and of the individual parts was increased. The lower portions of the leaves and stems of the potato proved to be very sensitive to the chlorine ions. The movement of chlorine from the lower portions of various parts of the plant to the upper portions took place at a late stage of vegetation. Increased nitrogen in the medium decreased the chlorine intake by potatoes. Warington (73) employing pot and water culture experiments found that sodium molybdate produced toxic symptoms. Potato shoots turned reddish yellow when grown in soil containing the larger quantites of sodium molybdate.

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REPORT OF THE POTATO IMPROVEMENT COMMITTEE

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The general purpose of this Committee has been to foster a closer relationship among all individuals, agencies, and industries interested in the potato improvement program. Through the contacts of this Committee, working in cooperation with the Federal agencies, and particularly Dr. Henry Jones, Dr. F. J. Stevenson, and others, the interest in potatoes has increased during the past three years to a greater extent than in the previous twenty-five. A thorough study of Dr. Jones' report on potato projects and research which are in operation, and Dr. Stevenson's report of potato research, will clearly prove this point. Practically every state has shown interest in the national potato improvement program.

The need for this Committee was first recognized at the midwest potato breeding conference in 1935. Since that time the Committee has deemed it advisable to cooperate and sponsor, with the State and Federal agencies, in holding this annual potato breeding conference. In 1936 a second meeting was held in Iowa and Minnesota. During the past season the conference was held in New York State and tentative plans were made for the 1938 meeting which is to be held at Presque Isle. In 1939 the members will convene in Louisiana.

At these meetings the personal contacts and exchange of ideas of the potato breeders with others interested in potato research, has made it possible to obtain observational facts relative to local plant behavior and regional adaptation, and intricacies of breeding technique have been made available for immediate use that otherwise would not have been deemed worthy of publication. Another function of

the Committee is to stimulate more fundamental research with this important crop; and, third, that it encourages and works for the support of the financial needs of the State and Federal Stations. If we of the State Stations continue to ask the support and co-operation of the Federal agencies, we must then ask for an additional financial support for the Federal projects. During this past year efforts were made, and will continue to be made, for an increase in the Federal project.

Respectfully submitted,

Committee on Potato Improvement.

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SECTIONAL NOTES

ARKANSAS

All plantings have been completed in this section for two or three weeks, and in many instances the potatoes now range from eight to ten inches high. Unfavorable weather has damaged the stands to some extent. A frost on the night of the 2d of April has also "nipped" the potatoes in some areas, but this damage will likely be outgrown. On the whole the outlook and potential production of this section, is favorable. (Apr. 4).—G. W. WARE.

CALIFORNIA

The acreage on the floor of the Valley is expected to be about 23,000 with approximately 3,000 to be planted in the mountains at a later date. The harvest is expected to start in our early section within the next ten days. In fact, a very small quantity of lugged potatoes for the Los Angeles market is now in the process of harvest. The greater majority of our potatoes planted in the Shafter-Wasco area are not above ground. Three different nights of frost nipped the potatoes in the Shafter-Wasco area back to the ground in many fields. This will result in a later harvest in these particular fields and may reduce the yield, depending upon the individual field and upon the size of the plants. (Apr. 5).—M. A. LINDSAY.

The acreage in the Early Edison District is estimated at approximately 8,000 whereas in the Shafter District proper approximately 20,000 acres have been planted.

Growing conditions in the Shafter District have been rather unfavorable. It has been entirely too cold and they have had too much rain; also recent frosts have affected the oncoming crops, to a greater or less extent. According to present indications, the first shipments in lug boxes will start moderately in the Edison District by the 15th of April. Carload shipments in sacks will not reach any volume until the end of the month.

There is considerable complaint this year about seed, and the fields, on the average, do not look so good as usual. Whether this is because of the unfavorable growing conditions, poor selection of seed or both, it is difficult to tell.

In regard to the Stockton District, San Joaquin Valley—only approximately 1/10 of the estimated acreage of 10,000 has been planted as yet on account of the unfavorable weather which has prevailed. It has been unusually cold and wet.

A meeting was held on the 4th of April to obtain the consensus of opinion of the potato growers in this county regarding Government regulations and a State Marketing Agreement. No definite action was taken, pending similar meetings which will be held in Kern County and Southern California in the near future. It was felt that because of the great importance of these other Districts, their views should be known before a uniform policy could be determined. (Apr. 5).—E. MARX.

GEORGIA

Much of the potato seed stock that has been received by the growers in Georgia is still in storage. Excessive rains during the winter and early spring have made plantings quite late. However, the potato acreage this season will exceed, by far, that of any previous year. Much time and effort are being devoted to the production of clean stock. (Apr. 9).—H. L. COCHRAN.

IDAHO

No potatoes have been planted because of unfavorable climatic conditions. Intentions to plant however, will be approximately the same as last year, except the reduction that will be necessary in order to comply with the soil conservation program.

The potato market is stronger, the U. S. No. 1 ranging from 80

to 90 cents sacked and loaded; the U. S. No. 2 selling for 55 cents. All our supplies are cleaning up rapidly.—(Apr. 7).—E. P. WENGERT.

MAINE

There is much discussion at present concerning the Government acreage forecast for 1938. All indications point to widespread compliance with the Potato Goals or allotments under the new potato program of the Agricultural Adjustment Administration. Credit agencies are insisting that borrowers comply and there is widespread interest in the stabilization efforts being conducted among all factors of the industry.

Very conservative opinion believes that there will not be more than 160,000 acres planted for the state, which is 7,000 less than forecast.

A very interesting indication of confidence in the stabilization of the acreage program is shown by the activity in real estate. One large credit agency reports more interest in farm ownership than has existed for many years. Credit for this is largely given to confidence created by curtailment of acreage. Although, undoubtedly, it is generally held that mistakes will be made, nevertheless there is reason to believe that this program is simply another step forward in the development of sound agriculture.

Shipments to date amount to approximately 41,000 cars for Maine with probable shipments running to 50,000 cars or somewhat more depending on price factors. Prices have declined the past few days and the indications for the future show little promise of improvement. In fact, the outlook for the remaining supplies on hand is not at all bright in view of the heavy volume which will come from the early states within a short time.

The quality of the crop in storage has never been better for this time of year than is to be found at present. Growers and shippers are finally admitting that we did have a large crop of potatoes, although many have been very reluctant to admit it all season.

Our problems with necrosis are of deep concern to every one. This spring the better seed growers were very careful, when buying seed, to avoid sources where potatoes showed material necrosis. The results of the tests in Florida indicate that a substantial part of the trouble, at least, is the result of primary Leaf-Roll infection.

Low temperatures still prevail, with little evidence of spring weather preparatory to farming operations. Many growers, however, are beginning to treat seed and are getting ready for the big rush late. (Apr. 9).—FRANK W. HUSSEY.

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MISSISSIPPI

The 1938 potato acreage shows a decrease of fifteen per cent compared with 1937, or approximately 18,000 acres. The crop is ten days to two weeks earlier than normal, because of an exceptionally early spring. The condition of the crop is good, particularly in the southern end of the state where recent rains have not caused so much damage as in other sections.

Some shipments may be expected from the extreme southern part of the state about the first of May, but the bulk of the crop will move between the 15th of May and the 1st of June. The peak movement of potatoes from Mississippi is normally about the 1st of June. It is still too early to give any accurate estimate regarding the yield expected since this will be determined by the weather conditions during the next thirty days. (Apr. 6).—J. V. PACE.

NORTH DAKOTA

The spring movement of potatoes from North Dakota has well passed its peak. Practically all the potatoes to be shipped have moved from many of the stations.

It is too early to estimate definitely the planting plans for the season. It is predicted, however, that they will be approximately the same as they have been for the last two or three seasons. Planting in this state does not begin until the latter part of April and is not general until the first part of May. So far, it appears as though conditions will be favorable for planting when the time comes. (Apr. 4). —R. HASTINGS.

TENNESSEE

The low temperature that was experienced during the night of the 3d of April injured the Irish potatoes that were above ground. At this date it is difficult to estimate the acreage affected. (Apr. 6).—B. D. DRAIN.

VIRGINIA

The weather during the latter part of February and the early part of March was favorable for planting and practically all the crop was planted, even in the northern end of Accomac County, by the 20th of March. It is estimated that the acreage is approximately 15 per cent below that of last year.

The temperatures during the latter part of March were consider-

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ably above normal and very favorable for rapid sprouting of the seed pieces. In the Norfolk area and the lower part of the Eastern Shore Peninsula the potato plants in the earlier planted fields germinated during the latter part of March,—about two weeks ahead of normal. Cooler weather during the past ten days, however, has retarded growth and it is likely that the crop will not be much earlier than is normal.

No reports of seed rot have, as yet, been received at our Station and it is expected that an excellent stand will be obtained throughout most of the Virginia area.

A heavy rain last night (3 inch precipitation) may have leached nutrients from the soil. This followed a two-inch precipitation during the preceding forty-eight hours. It is likely that many growers will side-dress with nitrogen to replace losses by leaching from the lighter types of soil.

Hearings on the marketing agreement will be held at Painter on the Eastern Shore on the 19th of April, and at Norfolk on the 21st. It is believed that the Virginia growers will be solidly in favor of a marketing agreement. (Apr. 9).—H. H. ZIMMERLEY.

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